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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/601,540	09/06/2000	David Tomanek	6550-000017	4174

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EXAMINER	
BRITTAIN, JAMES R	

ART UNIT	PAPER NUMBER
3677	

DATE MAILED: 02/08/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/601,540	TOMANEK ET AL.	
	Examiner	Art Unit	
	James R. Brittain	3677	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 September 2004 and 23 November 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,24-29,35,36,39-42,44-51,57,58,61-65,67-75 and 77-84* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *24-29,35,36,39-42,44-51,57,58 and 61-65* is/are allowed.

6)☒ Claim(s) *1,67-75 and 77-84* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) was timely paid, the finality of the previous Office action was withdrawn with the filing of the submission of September 13, 2004 pursuant to 37 CFR 1.114. Applicant's submissions filed on September 13, 2004 and November 23, 2004 have been entered.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 82 is rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The limitation "wherein no attachment of nanotubes is required for fastening" has no written description in the application as filed and is therefore new matter. The nanotubes are attached to the substrate elements as clearly described in applicant's specification and the fastening can only take place when the nanotubes are attached to the substrate elements. There is no basis in the specification as filed for this negative limitation.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 82 and 83 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

It is not particularly pointed out what scope is of the limitation "wherein no attachment of nanotubes is required for fastening" (claim 82). Obviously, attachment of the nanotubes to the substrate would appear to be required in order for fastening to take place and applicant is not giving sufficient notice to one reading this claim of what the scope of his invention consists of.

In regard to claim 83, the limitation "the extending nanotubes" lacks clear antecedent basis because it is not particularly pointed out if this refers to the nanotubes on only one fastening element or both fastening elements.

Claim Rejections - 35 USC § 102/103

The following is a quotation of the appropriate paragraphs of 35 U.S.C. §102 that form the basis for the rejections under this section made in this Office action:

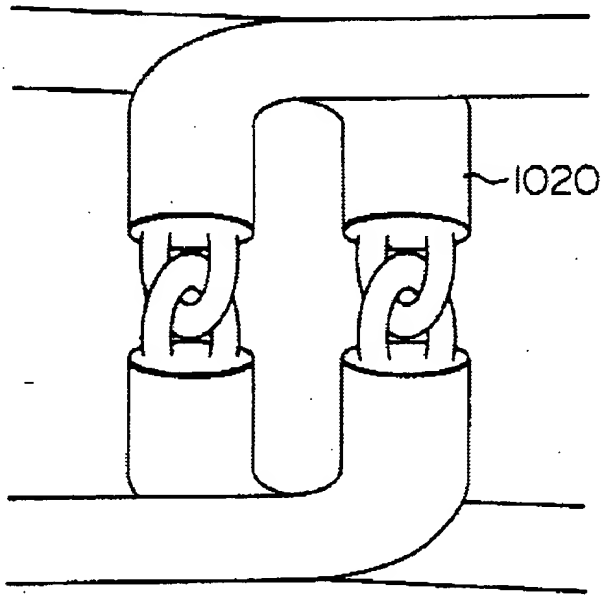
> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

The following is a quotation of 35 U.S.C. §103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 67-69, 72-75, 79, and 80-84 are rejected under 35 U.S.C. 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. 103 as obvious over Ihara et al. (US 5464987).

Ihara et al. (figure 10) teaches a microfastening system comprising a first fastening element comprising two nanotubes, each comprising a half torus, secured to a lower substrate comprising the two surfaces facing upward interengaging with a second fastening element comprising two nanotubes, each comprising a half torus, secured to an upper substrate comprising the two surfaces facing downward. The middle portion of figure 10 is reproduced below.



The nanotubes are mechanically interconnected as shown in the above figure. Ihara indicates the method of making the microfastening system comprises harvesting half-tori by dividing the toroidal molecules in two and then fixing the molecules in opposite directions to each other to the respective substrate (col. 8, lines 4-13). This interconnection inherently requires the elements of the connection be so disposed so as to become mechanically interconnected as

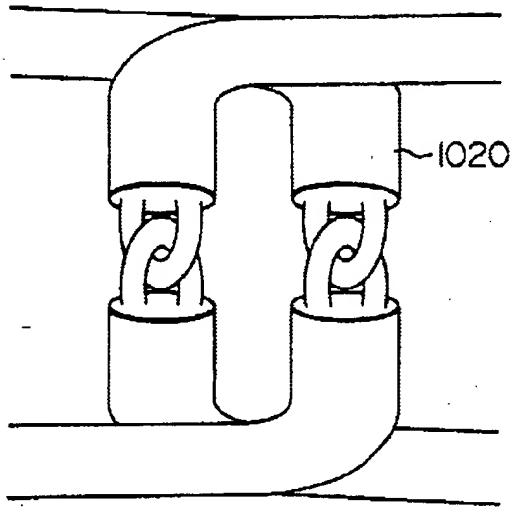
the first and second fastening elements comprising the substrates and half-tori are joined by advancing toward each other. While this bringing together of all the components to form the fastener is not stated in Ihara et al. it is the obvious process by which the final product is created and as such is also obvious over the teachings of Ihara et al. As to claim 67, the toroidal molecules are carbon nanotubes that include pentagons and heptagons to provide their curvature as shown in figure 1 and are therefore considered functionalized and further the curved and therefore nonlinear nanotubes have one end defined by the two open ends of each half-torus that is joined to the substrate and an intermediate end distal the substrate that is free of the surface of the substrate.

In regard to claim 68, Ihara et al. (figure 10) teaches a microfastening system comprising a first fastening element comprising two functionalized nanotubes, each comprising a half torus, secured to a lower substrate comprising the two surfaces facing upward interengaging with a second fastening element comprising two functionalized nanotubes, each comprising a half torus, secured to an upper substrate comprising the two surfaces facing downward. The toroidal molecules are carbon nanotubes that include pentagons and heptagons to provide their curvature as shown in figure 1 and are therefore considered functionalized. Ihara indicates the method of making the microfastening system comprises harvesting half-tori by dividing the toroidal molecules in two and then fixing the molecules in opposite directions to each other to the respective substrate (col. 8, lines 4-13). This interconnection inherently requires the elements of the connection be so disposed so as to become mechanically interconnected as the first and second fastening elements comprising the substrates and half-tori are joined by advancing toward each other. While this bringing together of all the components to form the fastener is not stated in

Ihara et al. it is the obvious process by which the final product is created and as such is also obvious over the teachings of Ihara et al. As to claim 69, the substrates are indicated above as being in figure 10, the two surfaces facing upward comprising the lower substrate and the two surfaces facing downward comprising the upper substrate. In regard to claim 72, the nanotubes form half-tori and are therefore a non-linear shape. As to claim 73, the structure of the half-tori explicitly meets the loop shape. In regard to claim 75, the toroidal molecules are carbon nanotubes that include pentagons and heptagons to provide their curvature as shown in figure 1 and are therefore considered functionalized and further the curved and therefore nonlinear nanotubes have one end defined by the two open ends of each half-torus that is joined to the substrate and an intermediate end distal the substrate that is free of the surface of the substrate.

In regard to claim 74, Ihara et al. (figure 10) teaches a microfastening system comprising a first fastening element comprising a functionalized nanotube comprising a half torus interengaging with a second fastening element comprising a functionalized nanotube comprising a half torus. The toroidal molecules are carbon nanotubes that include pentagons and heptagons to provide their curvature as shown in figure 1 and are therefore considered functionalized by having this structural modification from the hexagon in localized areas. Ihara indicates the method of making the microfastening system comprises harvesting half-tori by dividing the toroidal molecules in two and then fixing the molecules in opposite directions to each other to the respective substrate (col. 8, lines 4-13). This interconnection inherently requires the elements of the connection be so disposed so as to become mechanically interconnected as the first and second fastening elements comprising the half-tori are joined by advancing toward each other. While this bringing together of the two components to form the fastener is not stated in Ihara et

al. it is the obvious process by which the final product is created and as such is also obvious over the teachings of Ihara et al. The middle portion of figure 10 is reproduced below.



In regard to claim 79, the nanotubes form half-tori and are therefore functionalized to a non-linear shape. As to claim 80, the structure of the half-tori attached to the substrate explicitly meets the loop shape.

In regard to claim 80, Ihara et al. (figure 10) teaches a microfastener system comprising a first fastening element comprising two functionalized nanotubes, each comprising a half torus, secured to a lower substrate comprising the two surfaces facing upward interengaging with a second fastening element comprising two functionalized nanotubes, each comprising a half torus, secured to an upper substrate comprising the two surfaces facing downward. Ihara indicates the method of making the microfastening system comprises harvesting half-tori by dividing the toroidal molecules in two and then fixing the molecules in opposite directions to each other to the respective substrate (col. 8, lines 4-13). This interconnection inherently requires the elements of the connection be so disposed so as to become mechanically interconnected as the first and second fastening elements comprising the substrates and half-tori are joined by advancing toward

each other. While this bringing together of all the components to form the fastener is not stated in Ihara et al. it is the obvious process by which the final product is created and as such is also obvious over the teachings of Ihara et al. As to claim 82, applicant's nanotubes are attached to the substrate as are those of Ihara et al. and so far as definite, this limitation is met.

In regard to claim 83, this claim does not particularly point out that the nanotubes on both fastening elements must be permanently fixed to their respective fastening element during the action of advancing the elements toward each other. Since this is not claimed, the bringing together of the substrates and half-tori results in a final joined product that falls within the scope of the claim and is inherently capable of having some of the half-tori secured to a substrate and another half-tori threaded therethrough and secured to the advancing opposite substrate.

As to claim 84, Ihara et al. (figure 10) teaches a microfastening system comprising a first fastening element comprising two functionalized nanotubes, each comprising a half torus, secured to a lower substrate comprising the two surfaces facing upward interengaging with a second fastening element comprising two functionalized nanotubes, each comprising a half torus, secured to an upper substrate comprising the two surfaces facing downward. The toroidal molecules are carbon nanotubes that include pentagons and heptagons to provide their curvature as shown in figure 1 and are therefore considered functionalized. Ihara indicates the method of making the microfastening system comprises harvesting half-tori by dividing the toroidal molecules in two and then fixing the molecules in opposite directions to each other to the respective substrate (col. 8, lines 4-13). This interconnection inherently requires the elements of the connection be so disposed so as to become mechanically interconnected as the first and second fastening elements comprising the substrates and half-tori are joined by advancing toward

each other. The half-tori are mated when forming the lock and fastened together when attached to their respective substrate. While this bringing together of all the components to form the fastener is not stated in Ihara et al. it is the obvious process by which the final product is created and as such is also obvious over the teachings of Ihara et al.

Claims 70 and 77 are rejected under 35 U.S.C. §103 (a) as being unpatentable over Ihara et al. (US 5464987).

Ihara et al. (figure 10) teaches a microfastening system comprising a first fastening element comprising two functionalized nanotubes, each comprising a half torus, secured to a lower substrate comprising the two surfaces facing upward interengaging with a second fastening element comprising two functionalized nanotubes, each comprising a half torus, secured to an upper substrate comprising the two surfaces facing downward. The toroidal molecules are carbon nanotubes that include pentagons and heptagons to provide their curvature as shown in figure 1 and are therefore considered functionalized. Ihara indicates the method of making the microfastening system comprises harvesting half-tori by dividing the toroidal molecules in two and then fixing the molecules in opposite directions to each other to the respective substrate (col. 8, lines 4-13). This interconnection inherently requires the elements of the connection be so disposed so as to become mechanically interconnected as the first and second fastening elements comprising the substrates and half-tori are joined by advancing toward each other. While this bringing together of all the components to form the fastener is not stated in Ihara et al. it is the obvious process by which the final product is created and as such is also obvious over the teachings of Ihara et al. The difference is that Ihara et al. doesn't explicitly teach what the material of the substrate comprises for the mechanical connection of figure 10. However, it is

taught that silicon is a material to which the molecules can be adsorbed (col. 5, lines 26-29). It would have been obvious to recognize from the teaching of Ihara et al. that silicon is a material to which the half-torus molecules can be adsorbed and therefore utilize it for the substrate.

Claims 71 and 78 are rejected under 35 U.S.C. §103(a) as being unpatentable over Ihara et al. (US 5464987) in view of Yakobson et al. (Fullerene Nanotubes: $C_{1,000,000}$ and Beyond).

Ihara et al. (figure 10) teaches a microfastening system comprising a first fastening element comprising two functionalized nanotubes, each comprising a half torus, secured to a lower substrate comprising the two surfaces facing upward interengaging with a second fastening element comprising two functionalized nanotubes, each comprising a half torus, secured to an upper substrate comprising the two surfaces facing downward. The toroidal molecules are carbon nanotubes that include pentagons and heptagons to provide their curvature as shown in figure 1 and are therefore considered functionalized. Ihara indicates the method of making the microfastening system comprises harvesting half-tori by dividing the toroidal molecules in two and then fixing the molecules in opposite directions to each other to the respective substrate (col. 8, lines 4-13). This interconnection inherently requires the elements of the connection be so disposed so as to become mechanically interconnected as the first and second fastening elements comprising the substrates and half-tori are joined by advancing toward each other. While this bringing together of all the components to form the fastener is not stated in Ihara et al. it is the obvious process by which the final product is created and as such is also obvious over the teachings of Ihara et al. The difference is that Ihara et al. doesn't utilize multi-walled nanotubes. However, Yakobson et al. (figure 2) suggests that multi-walled nanotubes are well known and from elementary mechanics it is well understood that multiple walls are stronger than single

walled structures. As it would be beneficial to make the mechanical connection of Ihara et al. stronger, it would have been obvious to modify the nano-scale mechanical connection of Ihara et al. so that the half-tori are multi-walled in view of Yakobson et al. providing evidence of such structures as being well known and their use would be desirable for their inherently greater strength over single-walled structures, thereby providing a stronger mechanical connection.

Allowable Subject Matter

Claims 24-29, 35, 36, 39-42, 44-51, 57, 58 and 61-65 are allowed.

Response to Arguments

Applicant's arguments filed September 13, 2004 have been fully considered but they are not persuasive.

Applicant argues the limitation indicating that the nanotubes are disposed so as to become mechanically interconnected as they advance toward one another is a structural limitation that distinguishes over Ihara et al. This argument is advanced for independent claims 1, 68, 74, 81 and 83. The argument is unpersuasive because Ihara indicates the method of making the microfastening system comprises harvesting half-tori by dividing the toroidal molecules in two and then fixing the molecules in opposite directions to each other to the respective substrate (col. 8, lines 4-13). This interconnection inherently requires the elements of the connection be so disposed so as to become mechanically interconnected as the first and second fastening elements comprising the substrates and half-tori are joined by advancing toward each other. While this bringing together of all the components to form the fastener is not stated in Ihara et al. it is the obvious process by which the final product is created and as such is also obvious over the teachings of Ihara et al. Having the elements of the micro-fastener disposed so that the half-torus

nanotubes become mechanically interconnected must be accomplished by the nanotubes advancing toward one another. An indication of the breadth of the claim language in the independent claims is found in claim 83 where applicant for the first time provides a dependent claim indicating that some unspecified nanotubes are "permanently fixed" to the fastening element "during action of advancing the elements toward each other". This claim is evidence that permanent fixing of the nanotubes to their respective substrate is not considered by applicant to be a requirement for the scope of the independent claims at issue.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to James R. Brittain whose telephone number is (703) 308-2222. The examiner can normally be reached on M-F 5:30-2:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, J. J. Swann can be reached on (703) 306-4115. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

James R. Brittain
Primary Examiner
Art Unit 3677

JRB